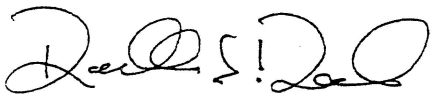
QUARTERLY PROGRESS REPORT
DRD 875MA-003
October 2001 – December 2001

Marshall Space Flight Center
Safety and Mission Assurance Mission Services Contract
NAS8-00179

Approved:



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MSFC S&MA Mission Services

January 10, 2002

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1.0 INTRODUCTION

Hernandez Engineering, Inc. (HEI) successfully performed all required activities and tasks, as described in this report, in fulfillment of their Safety and Mission Assurance (S&MA) Mission Services Contract (NAS8-00179) with NASA's Marshall Space Flight Center (MSFC). This report covers a three-month period of the contract's first quarter of the second year: October 2001 through December 2001.

2.0 GENERAL MANAGEMENT

2.1 Data Requirements

The first quarter of the first option year of the S&MA Mission Services contract was successfully completed on December 31, 2001. All Data Requirements (DR) Documents were submitted on or ahead of schedule throughout the quarter. They included DRD 875CD-001 On-Site Employee Location Listing; DRD 875MA-002 Financial Management Reports; DRD 875MA-003 Progress Reports (Monthly/Quarterly); DRD 875MA-006 Operations Plan, Problem Assessment Center (PAC); RD 875MA-007 Quarterly Open Problems List; DRD 875MA-008 Monthly Newly Opened/Closed Problem Summary; DRD 875SA-002 Mishap and Safety Statistics Reports.

2.2 Personnel Status

(b) (4)

3.0 BUSINESS MANAGEMENT

We have experienced no financial or business management problems during this period. We attribute this to close attention to details, effective use of established controls designed to efficiently respond to program changes---both anticipated and unexpected---and the continuing support of our corporate financial group's dedicated efforts at controlling overhead expenses.

The contract continues to have a total cost underrun at the end of this period---see the December 2001 Monthly Financial Report, DRD 875MA-002, for specifics. Attachment 2, Man-Hours Expended, of this report contains a description, by major task, of the total man-hours expended this period. (b) (4)

4.0 PERFORMANCE OF WORK AND USE OF FACILITIES AND EQUIPMENT

4.1 Safety

4.1.1 Industrial Safety (IS)

The Industrial Safety (IS) group completed the CY01 OSHA compliance annual facilities inspections and provided all required reports in a timely manner. IS also developed and submitted the CY02 annual facilities inspections schedule for QS30 approval. Also, IS performed 370 construction site compliance inspections to monitor adherence to OSHA and MSFC safety standards and performed verification checks of OSHA facility violations reported

closed by Building Managers in 55 facilities. All facility safety violations were documented in the HAZTRAK databases in order to assure MSFC's compliance with OSHA, NASA, and other consensus code requirements.

Among other activities, IS: (1) updated 13 facility fire evacuation plans; (2) participated in one pre-construction conference; (3) performed seven final safety inspections of facilities under renovation or construction; (4) reviewed 86 sets of facility design drawings for compliance with OSHA and consensus codes; (5) performed 61 fire drills; and, (6) participated in one training class to Area Managers and their Assistants.

In support of the MSFC initiative to become VPP Star Certified, IS continued to provide [redacted] to assist the VPP Communications and Implementation Teams, and general communication of safety awareness to all MSFC employees. [redacted] played an active role in readying MSFC for the VPP OSHA audit and Star certification. Assistance by the [redacted] and other IS team members included: (1) assisting QS01, the SHE/VPP Implementation and Training Committees, (2) developed and published multiple PowerPoint presentations; e.g., 'Introduction to the VPP'; (3) prepared several safety posters for use on the SHE web site; (4) drafted, published, reproduced, and distributed the weekly SHE Highlights; (5) completed publication of the first and second issues of the VPP newsletter, "VPP Star Search"; (6) actively participated in the MSFC Safety Day to include preparation, participation in safety activities and events; and, (7) as a short notice, high priority task, IS development or reviewed multiple checklists on hazardous activities for use by supervisors to identify hazardous operations in their assigned work areas. These checklists were also intended for use as tools for supervisors to self-evaluate work areas for VPP readiness.

As a major significant effort, IS continued to provide extensive support to the planning and review activities associated with the planned new Propulsion Research Laboratory (PRL). Support included: (1) participation in the weekly meetings; (2) performing numerous safety assessments and facility inspections of current hazardous operations scheduled to be relocated in the PRL; (3) performed an extensive safety review of the Jacobs Engineering/Sverdrup 60% Design package which included participation in the PRL requirements meetings with the MSFC PRL Project Team to discuss the review comments with the Jacobs/Sverdrup design team; and, (4) participation in a meeting with the MSFC Fire Engineer and the Jacobs Engineering Fire Systems Engineer which resulted in five action items to be reviewed and addressed in preparation for the 90% design; e.g., provide addressable photoelectric fire detection in all areas throughout the facility.

IS initiated, completed, or followed up on more than a dozen facility safety assessments (SA). Examples included: (1) completed the Operational Hazard Analysis (OHA) for the movement and transportation of the Integrated Equipment Assembly (IEA) in the Super Guppy Shipping Fixture (SGSF) using a dual crane lift and convoy from Redstone Army Airfield to building 4755; (2) completed the SA for testing the High Performance Antiproton Tarp (HiPAT) to be conducted in building 4566. As part of this effort IS also completed reviewing three hazard operating procedures associated with the HiPAT, the Super Conductor Magnet System, the Dual Ion Source, and the HiPAT operations; (3) on short notice, IS completed an OHA for the ISS S1-Stuctrual Test Article (STA) Move and Handling Operation at MSFC. The OHA addressed the arrival of the Super Guppy, transloading, convoy to and from Redstone Army Airfield and subsequent lifting at building 4708. As part of this support, IS participated in the Move

Readiness Review (MRR); (4) completed the OHA for the Vacuum Chamber Vessel dual crane critical lift; and, (5) IS performed or verified numerous explosives quantity-distance (Q-D) calculations in support of MSFC to include reviewing the Q-D for the Cryogenic Tank Test Facility (CSTF).

As a significant strength, IS continued to provide dedicated, full-time safety and quality support to the MSFC Test areas. Examples of support included: (1) the pre-test and post-test activities for the 24" Solid Rocket Motor Insulation Motor; (2) the Zero-Boiloff/Optical Mass Gauge Test program by performing a SA and review of procedures for initial and follow-on testing using the Multipurpose Hydrogen Test Bed (MHTB) as part of the ongoing testing using the MHTB to evaluate controlling cryogenic fluids used for propellants on the Shuttle and other space flight applications; (3) review of the proposed upgrades to the spray booth in building 4707; (4) review of the refurbishment to test cells in 4583; and, (5) performed multiple test procedure reviews.

IS continued to support the implementation of the NASA lifting standard, NSS 1740.9 by providing day-to-day advice and assistance to S&MA customers. In addition to performing several OHA's, IS served as the S&MA safety monitor for: (1) lifting and moving operations of the Vacuum Chamber Vessel which included lifting the vessel and moving/transporting it from the parking lot of building 4619 to the pit and stand inside the West end building 4619; (2) the dual crane critical load lift and convoy from Building 4755 to building 4708 of the ISS S5 Truss Structural Test Article (STA); (3) move and handling operations for the S1 Structural Test Article (STA) which included receiving, unloading from the Super Guppy, and convoying to the building 4708 East Airlock and on a later date convoy of the SGSF to the Redstone Arsenal Army Airport for retrieval by the Super Guppy; and, (4) administered hands-on proficiency examinations to four aerial lift operators, nine overhead-crane/hoist operators and two forklift operators in support of the MSFC Personnel Certification Program.

4.1.2 System Safety Engineering (SSE)

System Safety reviewed and provided comments to the Space Shuttle Main Engine (SSME) Integrated Hazard Analysis (IHA) and United Space Alliance (USA) Solid Rocket Booster (SRB) element Hazard Analysis (HA). In addition, System Safety participated in the investigation of the External Tank (ET) Liquid Hydrogen (LH2) recirculation line burst disc, and worked the Solid Rocket Booster (SRB) Thrust Vector Control (TVC) hydraulic pump compensator spool issue.

System Safety provided technical support for the following: Shuttle Safety Review Panels; STS-108 Preflight Assessment Review (PAR); STS-109 SRB/ET Mate Review, Vehicle Engineering Control Board (VECB) /Main Propulsion System (MPS) Failure Modes and Effects Analysis (FMEA)/Critical Items List (CIL) telecon, and STS-108 Pre Flight Readiness Review (FRR). System Safety provided technical support during STS-108 for the External Tank (ET) Huntsville Operation Support Center (HOSC) console.

System Safety continues to evaluate Unsatisfactory Condition Report (UCRs), and Problem Reports (PRs), as required to support the shuttle program, as well as reviewing changes for impacts to safety.

4.1.3 Payload Safety

Payload Safety completed/initiated four (4) safety data packages (SDPs). The Protein Crystal Growth (PCG) Single Locker Thermal Enclosure System (STES) Reflight Assessment for UF-1 was submitted to Johnson Space Center (JSC). The Microgravity Science Glovebox (MSG) Integrated Phase III Ground Safety Data Packages (GSDP) was submitted to Kennedy Space Center (KSC). In addition, a Preliminary Hazard Analysis (PHA) was initiated for ACES (ALTUS Cumulus Electrification Study). Payload Safety also initiated a Re-flight SDP for Biotechnology Carrier (Bic) on UF-2. In addition to SDP development, Payload Safety continued development of five (5) SDP's and reviewed/submitted comments for eight (8) SDPs.

Payload Safety supported the Flight Payload Safety Review Panel (PSRP) for Glovebox Integrated Microgravity Isolation Technology (gLIMIT), Towards Understanding Pore Formation and Mobility during controlled Directional Solidification in a Microgravity Environment Investigation (PFMI)/ Solidification Using a Baffle in Sealed Ampoules (PFMI/SUBSA), and MSG Integrated Phase III. Payload Safety presented the gLIMIT, PFMI/SUBSA and MSG Integrated HR's resulting in, respectively, 2/4, 6/10, and 4/5 approved hazards reports. Payload Safety participated in a special topic Safety Review Panel (SRP) telecon discussion about the MPLM/Orbiter Reflight Assessment. The MSG Integrated Phase III was successfully presented to the Marshall Payload Safety Readiness Review Board (MPSRRB). Payload Safety also provided technical/administrative support for the MSG Integrated Phase III MPSRRB. Payload Safety continues completion of the Propulsive Small Expendable Deployers Systems (ProSEDS) Missile System Prelaunch Safety Package (MSPSP). Payload Safety provided an Eastern Western Range (EWR) 127-1 tailoring matrix for the Space Launch Initiative (SLI) RS83 Engine project. Payload Safety traveled to California to present the ProSEDS safety status to the Air Force Space & Missile Systems Center (SMC) Launch Program Office. Payload Safety performed a Fault Tree Analysis (FTA) for ProSEDS Hollow Cathode Plasma Collector (HCPC). Payload safety also attended Computer-Aided Fault Tree Analysis (CAFTA) software training to enhance FTA capabilities.

System Safety participated in the following technical meetings: Solar B X-Ray Telescope (XRT) and Focal Plane Package (FPP) Critical Design Reviews (CDRs), ACES Baseline Delta Review (BDR), ACES BDR Preboard, and Bic UF-1 Preship Review and Flight Readiness Review (FRR), Co-Optimized Booster For Reusable Applications (COBRA) Electronic Health and Monitoring System (EHMS) Technical Interchange Meeting (TIM), PSRP Quarterly tagup telecon, Node 2 Test & Verification (T&V) TIM at KSC. Payload Safety also traveled to KSC to evaluate MSG Non-Compliance Reports (NCRs) for impacts to MSG Integration Hazard Analysis. In addition, System Safety provided support to the Contractor Support Console at Johnson Space Center (JSC) during the UF-1 Mission for Multipurpose Logistics Module (MPLM). Payload safety initiated S&MA plans for COBRA and RS83 Engine projects. In addition, Payload Safety reviewed and provided comments to the Miscible Drop in Microgravity (MDMG) S&MA Plan.

Two Payload Safety engineers have been acting S&MA leads for thirteen (13) projects in absence of civil servant availability. Payload Safety has also initiated a Lessons Learned Data base to track and document issues and concerns.. (b) (6) have been attending Propulsion classes at University of Alabama, Huntsville (UAH). One Payload Safety

engineer has been trained as a Risk Management instructor and has taught one class in Langley, VA.

4.2 Reliability

4.2.1 Reliability & Maintainability (R&M) Engineering

In support of Shuttle Projects, significant R&M activities included participation in the flight readiness and launch support activities for STS-108 as well as active participation in various anomaly resolution teams. R&M participated in a number of internal SRB reviews, including the Command Receiver Decoder qualification review, Integrated Electronics Assembly (IEA) upgrades review, Altitude Switch Assembly Technical Interchange Meeting, and the IEA Range Safety Systems Independent Operations Assessment Team (IOAT) review. R&M actively participated in the investigation of suspect RSRM Carbon Cloth Phenolic in the throat ring of the Nozzle in the RSRM-82B motor (STS-108). R&M participated in review of nozzle test data to assess a worst case pocketing event and related potential failures and supported development of flight rationale for this issue. R&M participated in the RSRM Nozzle Adhesive Replacement TIM given by Thiokol at MSFC. Material, design and process changes resulting from replacement of the current obsolete adhesives with a new adhesive were all reviewed to ensure the change did not have any detrimental impacts on RSRM reliability.

In support of the 2nd Generation Reusable Launch Vehicle program, R&M continued providing R&M discipline support to S&MA, including review of program documentation to ensure that R&M requirements are correctly specified.

In support of the International Space Station (ISS) Node 2 and 3, R&M has been extensively updating the Node 2 FMEA/CIL and submitting it to ISS R&M on a subsystem-by-subsystem basis. As part of this update, the Node 2 analysis has been compared to the baselined USL analysis to ensure consistency, previously unanalyzed hardware has been included, and all worksheets are being reviewed and concurred with by appropriate Node 2 subsystem engineers. R&M also coordinated and presented the first set of critical items associated with the Node 2 Thermal Control System to the ISS Safety and Mission Assurance Panel and then to the Space Station Program Change Board for ISS management approval. Due to budget constraints, R&M was directed to stop work on the Node 3 Regenerative ECLSS for approximately two months. Upon direction to continue ECLSS support, R&M restarted development of the FMEA/CIL, Limited Life Items List, and Maintainability Analysis for the WRS and OGS in support of the ECLSS Integrated Rack CDR scheduled for February 2002.

In support of Science & Payloads, R&M participated in the Critical Design Reviews for the Solar-B X-Ray Telescope and Focal Plane Package science instruments, and is in the process of updating for release the Solar-B FMEA. R&M also continued the development of the MSRR integrated rack FMEA/CIL and Maintainability Analysis in support of the MSRR integrated payload rack CDR.

4.2.2 Problem Assessment Center (PAC) Operations

HEI's PAC personnel processed and coordinated disposition of problem reports, supported launch milestones, coordinated the MSFC Problem Assessment System, and operated the Corrective Action System (CAS). The PAC received and entered 22 new problem reports (PRs) into MSFC's Problem Reporting and Corrective Action (PRACA) System, coordinated MSFC interim closure of 38 PRs, received 17 prime contractor closure recommendations, supported MSFC full closure of 18 PRs, coordinated non-problem closure of 2 problems, and performed 98 individual PR database updates and reviews. We conducted 8 SSME problem review boards, dispositioning 25 of 26 problem reports presented. The PAC generated or updated trends for all SSME, RSRM, and SRB problems submitted as newly opened or for closure. We also generated and distributed monthly bubble trend risk charts for 1 and 5-year problem data and 12-month new problems moving averages for data over the last year.

The PAC supported 7 pre-launch milestones for STS-108 and -109 in addition to coverage of the Level A countdowns and launch of STS-108. This included providing open problems listing and counts, real-time meeting support, and/or issue analysis on open MSFC PRACA critical problems. In support for the launch attempts, we extracted and provided copies of KSC PRACA problems as they were entered at KSC for MSFC S&MA review during Level A countdown, and used a PAC-generated spreadsheet of all countdown problems from STS-72 (1996) through current to provide additional data regarding problems occurring and being discussed during Level A..

In problem system coordination, the PAC conducted 2 SRB Problem Assessment System (PAS) status reviews for the SRB Chief Engineer, performed PRACA process audits on LMMSS ET, USA-SRB, and Rocketdyne and Pratt and Whitney SSME. We also implemented revised MSFC PRACA codes in keeping with Change 23 of NST 08126, "Shuttle PRACA System Requirements" and assisted in preparation and authorization of relocation of the MSFC UNIX PRACA server in coordination with HEI's IM, AD32, AD23, and ODIN.

The PAC provided various problem data in support of NASA and MSFC analyses. Special activities included providing SSME problem data on combustion problems by subsystem from 1996 through November, 2001; providing a spreadsheet of SSME Alternate High Pressure Turbopump MSFC PRACA problems, providing 4 typical hydraulic actuator sleeve and spool galling problems to the SSME Project Office, providing in-flight anomaly data to the Space Shuttle Project Office, and supporting a telecon between SRB S&MA and NASA HQ on SRB PRACA processing. These were in addition to regular monthly reporting of newly opened/newly closed MSFC PRACA problems and new opened shuttle element PRACA problems for presentation to the Human Exploration and Development of Space; maintaining the PRACA entry on the S&MA RADAR stoplight chart; quarterly generation of the Open Problems List; daily distribution of KSC Shuttle PRACA problems and the report from MSFC's resident office at KSC, daily maintenance of the Open Against Next Mission problem summary available on the web; the S&MA Daily Report of recent KSC problems, ALERTs, and MSFC PRACA problems open against the next launch; and generation of various ad hoc reports on problem system activity.

(PWS 6.3.3) In implementation and operation of the MSFC CAS, we received 47 potential CAS reports, screened 44 draft Recurrence Control Action Requests (RCARs), and initiated 4 new RCARs. We received 6 responses from laboratory points of contact with either disposition

rationale or response extension requests. We coordinated Corrective Action Board review of 3 RCARs, resulting in full closure of 2 RCAR. We also provided open RCAR status reports and discussion at the ISO Implementation Team and Focus Team meetings, issued monthly RCAR status and delinquent response reports, and presented monthly metric charts of RCAR activities and statuses at the ISO Implementation Team. In addition, we researched and briefed S&MA MMS coordinators on ECLSS's continuous risk management preventive action implementation. Furthermore, we assisted presentation of CAS activities and metrics at the regular MSFC Quality Council meeting, and received no adverse findings as we were surveyed on corrective/preventive action as a part of the NQA full scope and ISO 9001/2000 surveillance audit.

4.2.3 ALERT Program

HEI's ALERT support included both regular and special activities as we coordinated MSFC ALERT processing. HEI received and distributed 18 ALERT announcements for MSFC review and obtained 366 responses from MSFC project, contractor, and laboratory contacts. One of the released ALERTs was an MSFC-initiated NASA advisory and three of them were coordinated through S&MA management for quick release during the STS-108 mission preparation freeze. We developed a display and brochures on GIDEP and presented it at the MSFC Safety Day for our NASA HQ-required annual awareness activity and prepared and submitted MSFC's GIDEP Annual Utilization Report. We also participated in the quarterly NASA ALERT representative teleconference.

4.3 QUALITY (QE)

Space Transportation

External Tank (ET) Quality Engineering (QE) assisted in the preparation of STS-108 PAR presentation material for the LH2 recirculation line burst disc investigation. ET QE also prepared a one-page summary for implementation of the Gaseous Hydrogen ground vent disconnect due to a poppet failure on the previous launch. ET QE also participated in qualification activities associated with the composite GH2 press-line fairing and nonconformance reviews of the Composite Nose Cone due to material property failures.

Solid Rocket Booster (SRB) QE participated the identification of Booster Separation Motor (BSM) delta qualification requirements with United Space Alliance (USA) SRB Element and Chemical Systems Division (CSD). QE participated in the investigation of a Hydraulic Pump Anomaly at Parker Abex and Critical Process control issue at MOOG. QE participated in two Confined Detonating Fuse Assembly Lot Review and one Frustum Linear Shaped Charge Lot Review. QE participated in a team activity with USA SRB Element to develop a new Quality System flow down document to replace the NSTS5300.4 (1D-2).

Space Shuttle Main Engine (SSME) Quality Engineering continued to provide support for pre-test planning sessions, post-test data reviews and acceptance reviews associated with acceptance of flight engine assemblies and related components. Quality Engineering provided additional support to the PSIG Subcommittee working the STS-104 In-flight Anomaly (over pressurization of Orbiter 17 inch manifold, post MECO), assisting in implementation of the team's recommended corrective action. The two-second delay in the SSME pre-valve closure sequence was successfully flown on the STS-108. Quality Engineering prepared two one-page summaries for the STS-108 Preflight Assessment Review (PAR).

QE supported the Joint Group on Pollution Lead-Free Solder Project and the NASA Workmanship Technical Committee with the review and drafting of addendums to class 3 of J-STD-001C "Requirements for Soldered Electrical and Electronic Assemblies" to support NASA Requirements. Quality Engineering also supported QS20 with the workmanship standards requirements for the space shuttle system.

QE participated in the closure of the X-38 Project Material Review Board action to down grade the Electrical Interface Panel (EIP) to development hardware from qualification hardware. QE participated in the resolution of two discrepancies on the connectors that are part of the EIP. QE is supporting the project office to ship all the X-38 DPS in-house to JSC.

Software Quality Assurance (SQA)
HEI SQA conducted an SQA Software Requirements Specification traceability audit and a Software Development Plan audit of Materials Science Research Rack (MSRR-1) Project. SQA also supported the SOLAR-B, X-Ray Telescope (XRT) and Focal Plane Package (FPP) Critical Design Review. Continuous Risk Management (CRM) certified SQA Engineer prepared and presented at the SQA Monthly Status meeting, an overview of the role that CRM plays in SQA.

ISO
Quality Engineering has continued to play a key role to ensuring the maintenance of ISO 9000 at MSFC during this time period, as well as the upgrade to ISO 9001:2000 registration. These efforts have dealt with implementation of the ISO revision, training, maintenance of documentation, internal quality audits, and planning and support for the registrar surveillance and registration audit, including closure of corrective actions. Quality Engineering provided general ISO support, including consulting support on continual improvement, customer satisfaction and other aspects of ISO 9001:2000, to various MSFC Organizations.

QE supported SD40 during the NQA Audit as the point of contact. QE prepared and revised Organizational Work Instructions and investigated Nonconformance's. QE prepared and submitted 18 customer satisfaction surveys to SD40 Flight Principle Investigator customers.

Payloads
QE participated in a Focal Plane Package (FPP) Leg Failure Investigation Team, for the SOLAR-B Project, at the National Space Science and Technology Center (NSSTC). It was determined that the primary cause of the failure was fatigue in the legs.

QE supported a Pre-Board meeting for the Altus Cumulus Electrification Study (ACES) Project. The Pre-Board was successful and the ACES payload baseline Delta Review Board authorized the ACES team to proceed with the fabrication, integration and testing.

QE conducted quality surveillance for the Observable Protein Crystal Growth Apparatus (OPCGA) Project, at the University of California Irvine (UCI) Madison Office and their subcontractor Teledyne Brown Engineering. The surveillance team had two observations. It was noted that UCI was making excellent progress in attaining ISO compliance.

QE supported a Certification of Flight Readiness (CoFR), and a Pre-Ship Review / Flight Readiness Review (FRR) for the Protein Crystal Growth-Single Locker Thermal Enclosure

System (PCG-STES) scheduled for STS-108 (UF-1). There were no actions given to the Safety and Mission Assurance Team.

QE participated in the SOLAR-B X-Ray Telescope (XRT) Critical Design Review held at the NSSTC.

QE supported an incremental acceptance review for the Gravity Probe B Project. This review consisted of an in-depth evaluation of manufacturing procedures and as-run test procedures. Over 300 discrepancies were found by Quality Engineering and were corrected by Stanford University.

QE supported the MSG Flight Unit Acceptance Review held in Bremen, Germany. During this review10 Review Item Discrepancies (RIDs) were generated which included approximately 200 discrepancies to the Flight Unit Acceptance Data Package. QE is supporting the MSG Project by assisting in RID closeout being performed at KSC. Activity is ongoing.

Inspection and Test
HEI quality assurance provided expertise in all MSFC test areas to MSFC test engineers and contract support personnel. The plasma arc facility, X-33 hydrogen test facility, X-38 test facility, TS 116, TS 300, TS 500, and the hot gas test facility are examples of test areas supported by quality assurance. Test procedures and planning were reviewed to ensure proper quality and test requirements are met on a day-to-day basis. HEI Quality Assurance performed receiving inspection and witnessed assembly and testing for PCG, g-LIMIT, PCAM, VCD, ProSEDS, MSRR, X-37, X-38, SUBSA, PCAM, and OGS.

4.4 Information Management (IM)

During the quarter, Information Management (IM) deployed the Inventory of Hazardous Operation (IHOPs) application' incorporated the checklist function in IHOPs modules including metrics reporting and implementation of newly developed checklists, and incorporated numerous modifications to the application. An excel download feature was incorporated to provide IHOPs reports required by the Safety, Health and Environmental (SHE) Area Committee and Voluntary Protection Program (VPP) Team. Other modifications supported refined definition of requirements as well as user requested functionality. IHOPs will provide real-time reporting of hazardous operations information and will improve upon the previous manual process by automating yearly inventory reports to NASA Headquarters by the S&MA Industrial Safety (IS) Office.

Modification of other IS applications also provided significant process improvements. The Supervisor Safety Web Page (SSWP) application was revised to provide improved functionality and to incorporate changes requested by users. The MS Excel download function was incorporated to provide large organizations the capability to print their assignment matrix. The SSWP Organization Administrator module was revised to improve application performance for large contractor organizations. User requested changes that were completed include incorporation of delete a visit and a meeting functionality as well as the capability to edit a closed finding. The application that allows MSFC personnel to register for Safety training classes was modified to include class descriptions; provide notification when the class is full;

provide for an automated waiting list; and to enable the training organization to add and delete a class, remove personnel from a class, and automatically send email notification to affected personnel. Automated reporting charts for the Haztrak and Safety Concerns and Reporting System (SCRS) applications were revised, and SCRS was modified to allow item reassignment. In addition, IM developed the database and administrative screens for the Building database, which will contain centralized information supporting IS applications. The applications will be revised to retrieve building and associated representative information from the Building database rather than maintaining the information in several locations.

IM development efforts supported other S&MA organizations and support functions. The Problem Reporting and Corrective Action (PRACA) application was revised to modify codes per NASA Space Transportation System (NSTS) standard data code revisions. The As-Built Configuration and Status System (ABCSS) application was revised to incorporate revisions to the shelf life input and update function. The Customer Feedback application, which supports the Marshall Management System (MMS), was modified to incorporate changes to the search function.

Other IM activities included installation of National Fire Code (NFC) software upgrades for 28 users, support to server relocation activities, and incorporation of Section 508 compliance requirements per S&MA's 508 Compliance Retrofit Plan. In addition, significant support, including training, was provided for IHOPs and SSWP users.

4.5 Human Exploration and Development of Space (HEDS) Assurance

MSFC HEI IA visited the JSC Independent Assurance Office December 4 and 5. The visit was very informative and constructive. The discussions regarding policy, methods, and future work were very helpful. Meeting the JSC IA staff face to face will enhance future communications.

4.5.1 International Space Station (ISS) Independent Assessment

IA participated in the evaluation of the long term storage plan for the ISS Cupola. The cupola is being built by Alenia (Italy) and is scheduled to be delivered to KSC in August, 2002 (approximate date). Also, MSFC HEDS IA personnel assisted JSC HEDS IA personnel with ISS workmanship issues associated with Boeing at MSFC.

4.5.2 Space Shuttle Independent Assessment

MSFC IA participated in the evaluation of the SRB Hydraulic Pump Compensato Spool investigation in support of the STS-108 (and subsequent) missions. MSFC IA evaluation of the issue resulted in the conclusion that this issue was not an impact to the launch of STS-108. A summary of the issue was provided to the SSP IA Manager. MSFC IA also investigated a flight issue concerning cracks that were discovered in the SSME low pressure oxidizer turbopump nozzle vanes. A summary of the issue was provided to SSP IA via email.

MSFC IA evaluated three engineering changes that were incorporated for the first time on the STS-109 ET. The evaluation was presented at the SSP HEADS IA telecon. The report for the

assessment of certain aspects of the Thiokol Quality Assurance Program was delivered to JSC IA in October. A schedule for MSFC Shuttle Element meetings was also delivered to JSC IA

4.6 Project Assurance

HEI Project Assurance (PA) personnel provided technical support and assessments of Space Shuttle flight readiness for Pre-launch Assessment S&MA reviews and the Center Director's Technical Issues Briefing for STS-108. HEI also provided support at the HOSC during the launch of STS-108, during the reporting period. PA supported the Safety Integration console from "Level A" through main engine cutoff. No major issues on the MSFC elements were worked during the countdown. Launch occurred on the third attempt. HEI personnel provided project assurance support for the ET, SRB, SSME and RSRM S&MA Assurance Offices.

In support of the Space Shuttle S&MA Integration Office, the following tasks were performed: PA coordinated MSFC S&MA participation in three (3) Space Shuttle System Safety Review Panel Teleconferences, downloading presentation materials and providing copies for local participants. PA also reviewed the KSC Launch and Landing Critical Items List (CIL) waivers and Hazard Report (HR) updates and JSC Government Furnished Equipment (GFE) HR and CIL updates and changes.

SSME Project Assurance provided support to the SSME Block II Reliability Assessment requested by the SSME Chief Engineer. The purpose of the assessment was to determine if reliability improvements have been made to the SSME Block II Design Configuration. HEI personnel provided data from the Boeing database and the PRACA database to support the reliability assessment.

During a Block II retrofit at the manufacturer, high cycle fatigue cracking was found during a routine penetrant inspection. This problem had been seen in the past on very high time units, but this unit has less hot-fire time than the DAR limits that were put in place after the previous occurrences. Space Shuttle Main Engine (SSME) Project Assurance has supported the investigation status telecons, and worked to prepare the L-2 Tagup Pre-Launch Assessment Review (PAR) presentation. The Problem Assessment Center (PAC) also assembled the failure history for the LPOTP nozzle and distributed that information to the interested personnel. Flight rationale was been developed using extensive successful history of the part in question along with stress analyses showing crack propagation will arrest prior to structural failure.

At the direction of QS20, SRB Project Assurance reviewed the SRB IEA Supportability Upgrade Project Plan published by NASA/JSC. This supportability upgrade initiated by the SRB element, delineates the project implementation strategy, identification of organizational responsibilities, required resources, project schedule and deliverable products for the two-phase project. Comments were provided for QS20 consideration.

SRB Project Assurance attended Radiographic Film Interpretation training in Houston, Texas. The course provided training in the fundamentals of radiographic theory, techniques, equipment, and focused on the interpretation of radiographs. The course was very beneficial and will enhance HEI capabilities in the performance of assigned responsibilities in pyrotechnic acceptance.

Working with QS20, Project Assurance organized the re-alignment of HEI team support responsibilities following recent changes in assigned HEI personnel. The replacement of QE personnel and re-allocation of some of the SRB pyrotechnic hardware support responsibilities from PA to QE necessitated that the SRB team support responsibilities be reassessed. PA held a meetings with QS20 and the HEI support team and reached agreement on how best to organize the HEI SRB team support with minimal disruption. All changes have been finalized and the HEI SRB team will continue to meet the customer's needs.

PA element leads participated in numerous project activities including RSRM FSM-9 test review, pyrotechnic phase reviews and Kaizen team support. SSME PA worked with Pratt and Whitney auditors in planning and successful execution of the SSME Consolidate Audit held at Pratt and Whitney in September. PA also participate in the Postflight Assessment of STS-104 SRB/RSRM hardware at Hanger AF in Cape Canaveral.

Product Assurance participated in a Critical Design Review (CDR) of the GP-B Gas Management Assembly (GMA) held at the contractor's location (Moog) in Buffalo, NY. PA received no action items; however, did negotiate with Moog Quality Assurance to provide Class II Discrepancy Reports (DRs) at the system level to the GP-B Program Office and Stanford University's (SU) Quality Assurance Manager. SU's contract with Moog only required reporting of Class I DRs. PA participated in the GP-B Flight Battery Acceptance Data Review held at the vender Eagle Picher in Denver, CO. Of the 11 action items opened at the review only 1 remains open and will be closed the week of 1/7/02. PA participated in a quarterly Technical Interchange Meeting (TIM) held at Vandenberg Air Force Base (VAFB) with Lockheed Martin (LM), SU, Kennedy Space Center's (KSC) Resident Safety Manger and VAFB System Safety (SS). The purpose of the TIM was to review KSC and VAFB SS comments on the GP-B Missile System Payload Safety Package (MSPSP). There are 11 action items to be worked and completed by LM prior to the next quarterly TIM.

"HEI Project Assurance (PA) personnel provided support to the Space Launch Initiative (SLI) Phase I Program and contractors Quarterly Reviews for Lockheed Martin, Boeing, Orbital Science, and Northrop Grumman. The reviews were supported along with side meetings discussing the connections between risk management, safety and reliability, and side meetings discussing the scope of the safety assessments for the Crew Return Vehicle (CRV), specifically Crew Survivability."

During the period, HEI Project Assurance completed staffing for the new Advanced Projects Assurance Department (APAD)/QS10. The staffing includes one Project Assurance Lead, two Test Area Quality Assurance support personnel, one Reliability engineer, one System Safety Engineer, two Reliability/Maintainability/Supportability (RMS) engineers and one Probababalistic Risk Assessment (PRA) engineer.

4.7 Risk Management and Risk Assessment

During this reporting period, Risk Assessment (RA) supported the Space Launch Initiative (SLI) Reliability, Maintainability, and Supportability (RMS) Working Group. RA participated in meetings that developed outlines for the program RMS Plan, schedule, and products decomposition and also attended the SLI Quarterly Review. RA updated the SLI-RMS website

to meet accessibility compliance standards, obtained approval and public release of the website, and made updates to the RMS team calendar and action item list on the website.

In support of SLI RMS, RA submitted a general outline for the possible mission phases of an ambiguous 2nd Gen RLV architecture; created a near term project schedule relating to the activities of the RMS Team for SLI in order to manage events so as to be synchronized with the Initial Architecture Technical Review (IATR); gave input to circulating white paper drafts focusing on RMS products and milestone convergence and RMS processes for the SLI program intended to be released in time for the Non-Advocate Review (NAR) and the IATR; met with representatives of Boeing to discuss progress in their architectures meeting the Space Launch Initiative Level 1 Requirements for the Loss of Crew (LOC), Loss of Mission (LOM), and Loss of Vehicle (LOV) Figures of Merit (FOM's); and performed a study to examine NASA's project and program protocol relating to Systems Engineering.

4.7.1 Risk Management

During this period, QS10 has transitioned responsibility for Center Continuous Risk Management training to HEI Project Assurance. Project Assurance also traveled to Langley Research Center and provided the CRM training to the X-43 C project. Twenty-two project personnel including civil service and contractors were in attendance. The class was very successful resulting in a framework being developed for the CRM Project Plan and a base lined set of risk being established. Project Assurance also scheduled a MSFC for training in January, 2001.

4.7.2 Space Shuttle Probabilistic Risk Assessment (PRA)

During this reporting period, Risk Assessment (RA) continued to work on the Space Shuttle PRA project. At the start of this period RA submitted the current Shuttle Propulsion PRA SAPHIRE models for the Phase I integration test being conducted by JSC SR&QA. The submitted SAPHIRE PRA models were reformatted and exported into Microsoft PowerPoint slides for bookkeeping, printing and referencing. The resulting PowerPoint files were sent to the respective PRA team members and to the various NASA contacts.

Also in support of the PRA, RA input the preliminary ET Intertank model provided by MAF into SAPHIRE, and reviewed it for modeling consistency. RA reviewed the Orbiter Main Propulsion System (MPS) models to identify and understand their interfaces with the propulsion elements. RA reviewed a list of propulsion models requested by the Orbiter PRA team with Rocketdyne and MAF PRA team members and submitted MSFC's responses to the Orbiter PRA Team and Technical Leads.

RA participated in weekly PRA status review telecons with NASA JSC and MSFC PRA contacts. RA attended a weeklong PRA Workshop sponsored by NASA HQ Code Q in Falls Church, VA. RA also participated in a two-day meeting of Shuttle PRA analysts representing all the elements. The main discussion topics were SAPHIRE software bugs and limitations, modeling of process errors, and achieving reasonable consistency in modeling. RA also developed a presentation describing PRA history, techniques, and software tools.

4.7.3 Reliability Prediction & Risk Assessment

During this reporting period, all Risk Assessment (RA) personnel attended a three-day reliability course ("Mechanical Design Reliability") given by the Reliability Analysis Center (RAC). The course gave a general survey of reliability methods and tools for a variety of situations RA provided significant support to the SRB program, including flight issue assessment. RA verified a risk assessment for the SRB that considered the possibility of an incorrect configuration hydraulic system part. The contribution to ascent risk was found to be very slight. RA also reviewed the risk analysis performed to evaluate a proposed change in target strength for the Aft Separation Bolt.

For the SRB Thermal Protection System, RA continued work on the proposed sample size reduction for measurements of MCC-1 (Marshall Convergent Coating 1). The recommendations on new methods have been well received by NASA and USA personnel, and RA is helping to implement them. During trip to KSC: presented recommendations to USA management and staff; spoke with staff about process, data and collection systems; discussed possible methods to input and analyze quality data; and discussed quality of density and thickness data.

Also in support of SRB, RA participated in the completion of action item #10 and continued work on action items #1 and #2 from the SRB Independent Operations Assessment Team (IOAT). RA presented recommendations for action item #10 to the USA board responsible for Problem Reporting actions and to NASA SRB and S&MA management. Action items #1 and #2 focus on quality, reliability, and nonconformance evaluation. RA participated in team telecons and offered assistance to any action item team needing it. The TPS sample size reduction work performed by RA was presented as an example for possible improvement in other areas. During trip to KSC, RA discussed databases and avenues of attack with USA SRB management and staff.

RA provided extensive support to the RSRM-82B Nozzle Throat Ring Team. RA performed data analysis showing that a pocketing event in test panels should not indicate an unsafe condition in the STS-108 launch hardware. RA conducted data analysis exploring expected duration of pocketing erosion events during testing and elucidated the concept of statistical tolerance bounds to S&MA and RSRM staff. RA worked with NASA personnel to help in understanding methods and implications behind statistical analyses done for flight rationale. RA performed data analysis exploring apparent change in ply angle on nozzle throat ring in recent production.

RA also supported RSRM by conducting a more general evaluation of RSRM Nozzle historical char and erosion data. RA worked with HEI R&M staff to evaluate data, trends and overall effectiveness of SPC efforts monitoring trends in postfire nozzle char and erosion data. The analysis included assessment of rayon and replacement materials in nozzle and also determination of process shift near RSRM-63 and reasons for that shift.

RA supported the SSME project through participation in the evaluation of SSME LPOTP Nozzle Vane cracks. Evaluation by RA included calculating a Single Flight Reliability life limit based on all LPOTP Nozzle hotfire time. RA personnel also explained statistical work performed by others. A demonstrated reliability estimate specifically for the STS-108 LOPTP Nozzles was made using the Weibayes method.

In support of SSME RA is assisted in several analysis efforts to evaluate SSME reliability versus power level and extended hotfire duration. Analysis efforts include demonstrated reliability, reliability growth modeling, use of environment adjustment factors on quantitative risk assessment estimates, and Weibull analysis.

5.0 COST REDUCTION ITEMS

Our continuing cross-utilization of employees, continuous analysis of work in progress to assure that application of resources meets the needs of the task, and the judicial acquisition and distribution of tools to enhance the efficiency of all team members allow us to minimize cost to the customer.